Evaluating the Impact of Design-Driven Requirements Using SysML

Completed Technology Project (2014 - 2018)

Project Introduction

The proposed research will develop SysML requirements modeling patterns and scripts to automate the evaluation of the impact of design driven requirements. Specifically, the research will develop a SysML requirements modeling pattern to model design-driven requirements, develop a script to integrate design-driven requirements into a SysML requirements tree within a trade study context to facilitate comparison of options, and develop a script to detect when conflicts exist between requirements or between requirements and the design. An important challenge in mid-lifecycle systems engineering is managing the balance between design capabilities and constraints and requirements. The design must fulfill all its requirements while accomplishing its mission goals. When unexpected requirement violations are found late in the design process, the chosen design solution must be evaluated against all existing requirements to ensure that an unrelated requirement has not been violated. Additionally, design decisions may impose new requirements. These new requirements must also be checked against all existing requirements and the design to ensure that there are no violations. With document-based methods, there is no explicit methodology for detecting when new requirements should be added to the requirements tree based on a design decision. The systems engineering or cognizant engineer must manually develop the implications of each design decision and decide if requirements should be added. In the V-model, there is an assumption that no new requirements will need to be added after design work has begun. On real projects, design choices frequently force changes of requirements causing rework and cost increases. These feedback relationships are difficult to track with traditional document-based methods due to their conditional nature and the cascading nature of changes in an integrated system. However, model-based systems engineering (MBSE) techniques and specifically SysML are able to model these relationships. Through successful development of the proposed capabilities, systems engineers can be confident that the implications of design decisions made late in the design cycle have been fully accounted for and projects will be able to make more reliable cost and schedule estimations.

Anticipated Benefits

Through successful development of the proposed capabilities, systems engineers can be confident that the implications of design decisions made late in the design cycle have been fully accounted for and projects will be able to make more reliable cost and schedule estimations.

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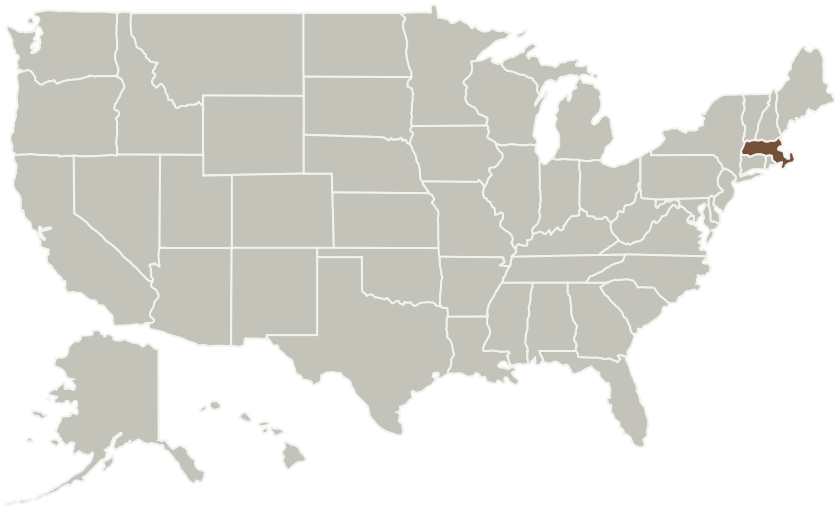
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Massachusetts Institute of Technology(MIT)	Lead Organization	Academia	Cambridge, Massachusetts

Primary U.S. Work Locations
Massachusetts

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Massachusetts Institute of Technology (MIT)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Rebecca A Masterson

Co-Investigator:

Mark Chodas

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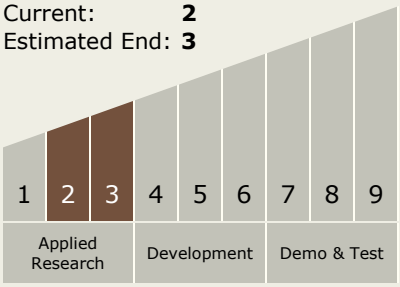
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX11 Software, Modeling, Simulation, and Information Processing
  - TX11.5 Mission Architecture, Systems Analysis and Concept Development
    - TX11.5.2 Tools and Methodologies for Performing Systems Analysis

Target Destination

Foundational Knowledge